



IFW AF 12829

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:

Willard L. Hofer et al.

Serial No.: 09/593,358

Filed: June 14, 2000

For: ROTATING GRIPPER
WAFER FLIPPER

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Group Art Unit: 2829

Examiner: Nguyen, J.

Atty. Docket: MICS:0053/FLE
99-0326

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Robert A. Manware

Sir:

APPEAL BRIEF PURSUANT TO 37 C.F.R. §§ 1.191 AND 1.192

This Appeal Brief is being filed in furtherance to the Notice of Appeal mailed on March 5, 2004, and received by the Patent Office on March 9 2004.

1. **REAL PARTY IN INTEREST**

The real party in interest is Micron Technology, Inc., the Assignee of the above-referenced application by virtue of the Assignment dated June 5, 2000 and recorded at reel 010920, frame 0534 on June 14, 2000.

2. **RELATED APPEALS AND INTERFERENCES**

Appellants are unaware of any other appeals or interferences related to this Appeal. The undersigned is Appellants' legal representative in this Appeal. Micron Technology, Inc., the Assignee of the above-referenced application, as evidenced by the documents mentioned above, will be directly affected by the Board's decision in the pending appeal.

3. **STATUS OF CLAIMS**

Claims 1-7 are currently under final rejection and, thus, are the subject of this appeal.

4. **STATUS OF AMENDMENTS**

No claim amendments were made after the Final Office Action was mailed.

5. **SUMMARY OF THE INVENTION AND OF THE DISCLOSED EMBODIMENTS**

The present application is directed to an apparatus for inspecting semiconductor wafers. Specification, page 2, lines 6-7. The illustrated embodiment, for example, provides means for visually inspecting the wafer without the user having to physically touch the wafer. *See e.g.*, page 10, lines 8-11; page 17, line 21 – page 18, line 8. Members of a holding structure hold the wafer and rotate the wafer about an axis that is perpendicular to the surface of the wafer and that extends through the axial center of the wafer. *See* page 9, lines 12-18; page 10, lines 4-11; page 10, line 7 – page 11, line 12. The holding structure is mounted on a rotational arm so that the holding structure with the secured wafer may rotate about a second axis parallel to the wafer surface. *See e.g.*, page 9, line 12- page 10, line 5.

6. **ISSUES**

Sole Issue:

Whether claims 1-7 are unpatentable under 35 U.S.C. § 103(a) as being unpatentable over the Moinpour et al. (U.S. Pat. No. 5,868,857) in view of Matsukawa et al. (U.S. Pat. No. 5,518,542) references.

7. **GROUPING OF CLAIMS**

Claim 1 will stand or fall separately. Claim 2 will stand with claim 1 or fall separately. Claim 6 will stand with claim 1 or fall separately. Claims 3-5 will stand or fall with claim 1. Claim 7 will stand or fall with claim 6.

8. **ARGUMENT**

As discussed in detail below, the Examiner has improperly rejected the pending claims. The Examiner has misapplied long-standing and binding legal precedents and principles in rejecting the claims under Section 103(a). Appellants strongly believe that this application should have been allowed in view of the response to the final rejection. Both the final rejection and the current rejection are clearly deficient, and the subject matter of the rejected claims is clearly patentable over the art of record. Accordingly, Appellants respectfully request full and favorable consideration by the Board, as Appellants strongly believe that claims 1-7 are currently in condition for allowance.

Sole Issue:

The Examiner rejected claims 1-7 under 35 U.S.C. § 103(a) as being unpatentable over Moinpour et al. (U.S. Pat. No. 5,868,857) in view of Matsukawa et al. (U.S. Pat. No. 5,518,542).

Specifically, the Examiner stated:

Regarding claim 1, Moinpour et al. disclose (fig 5B) a holding structure (510) having members arranged to hold and rotate (column 4 line 28-37) the substrate (502) about a first axis, the holding structure (510) being coupled to a rotatable member (512).

However, Moinpour et al. is silent on the rotatable member configured to rotate the holding structure about a second axis different from the first axis.

On the other hand, Matsukawa et al. teach on the rotatable member configured to rotate the holding structure (111a, 111b) about a second axis (flipping) different from the first axis for the purpose of providing the ability for testing system to test the wafer from different angle.

It would have been obvious to one having an ordinary skill in the art at the time of the invention was made to modify the robots arm of Moinpour et al. and providing the flipping feature as taught by Matsukawa et al. for the purpose of providing the ability for testing system to test the wafer from different angle.

Regarding claim 2, Moinpour et al. discloses (fig 5B) the members (510) comprises a plurality of wedge assemblies configured to rotate the substrate (502) about the first axis.

Regarding claim 3, Moinpour et al. discloses (fig 5B) the first axis is disposed generally perpendicular to a flat surface of the substrate (502) and extends generally through an axial center of the substrate.

Regarding claims 4, Matsukawa et al. discloses (fig 12) the holding structure comprises two L shaped gripping arms (111a, 111b) arranged to form a single U shape and configured to hold the substrate substantially parallel to the gripping arms.

Regarding claims 5, 6, Matsukawa et al. discloses the U shaped structure is configured to open and close about the perimeter of the substrate (W).

Regarding claim 7, Moinpour et al. discloses (fig 5B) the holding structure (510) comprises three wedge assemblies (as seen in the figure), at least one wedge assembly coupled to a motor (512) and configured to rotate the substrate (502) about the first axis disposed generally perpendicular to a flat surface of the substrate (502) and extending generally through an axial center of the substrate.

Appellants respectfully traverse this rejection. The burden of establishing a *prima facie* case of obviousness falls on the Examiner. *Ex parte Wolters and Kuypers*, 214 U.S.P.Q. 735 (PTO Bd. App. 1979). Obviousness cannot be established by combining or modifying the teachings of the prior art to produce the claimed invention absent some teaching or suggestion supporting the combination or modification. *See ACS Hospital Systems, Inc. v. Montefiore Hospital*, 732 F.2d 1572, 1577, 221 U.S.P.Q. 929, 933 (Fed. Cir. 1984). Accordingly, to establish a *prima facie* case, the Examiner must not only show that the combination or modification includes *all* of the claimed elements, but also a convincing line of reason as to why one of ordinary skill in the art would have found the claimed invention to have been obvious in light of the teachings of the references. *See Ex parte Clapp*, 227 U.S.P.Q. 972 (B.P.A.I. 1985). When prior art references require a selected combination to render obvious a subsequent invention, there must be some reason for the combination other than the hindsight gained from the invention itself, i.e., something in the prior art as a whole must suggest the desirability, and thus the obviousness, of making the combination. *Uniroyal Inc. v. Rudkin-Wiley Corp.*, 837 F.2d 1044, 5 U.S.P.Q.2d 1434 (Fed. Cir. 1988).

As described above, the present application is directed to an apparatus for inspecting semiconductor wafers. In one exemplary embodiment, a holding structure configured to hold a

wafer is mounted on a rotational arm to provide a user with a means of inspecting a wafer in any position without having to physically touch the wafer. The holding structure provides a mechanism for holding the wafer and for rotating the wafer about an axis that is perpendicular to the surface of the wafer and that extends through the axial center of the wafer. The arm provides a mechanism for rotating the wafer about an axis parallel to the surface of the wafer. The arm and holding structure are configured to facilitate the visual inspection of the wafer. Accordingly, claim 1 recites an apparatus for inspecting wafers comprising, “a holding structure having members arranged to hold and rotate the substrate about a first axis, the holding structure being coupled to a rotatable member, the rotatable member configured to rotate the holding structure about a second axis different from the first axis.”

With specific regard to independent claim 1, Appellants respectfully traverse the Examiner’s rejection for at least three reasons. First, the Examiner asserted that the Moinpour reference discloses “a holding structure having members arranged to *hold* and rotate the substrate about a first axis,” as recited in claim 1. Emphasis added. However, as discussed further below, it is clear that the structure disclosed in the Moinpour reference is only configured to rotate the wafer and is *not* configured to hold the wafer, as recited in claim 1. Second, the Examiner asserted that the Matsukawa reference discloses a “rotatable member configured to rotate the holding structure about a second axis different from the first axis,” as recited in claim 1. However, as discussed further below, the Matsukawa reference does not cure the deficiencies of the Moinpour reference. The Matsukawa reference only discloses a mechanism for rotating the wafer about a first axis, and then depositing the wafer on a spin chuck to facilitate rotating the wafer about a second axis, different from the first. Third, even if the cited combination did

disclose each of the elements recited in claim 1, the Examiner has not met his burden in establishing a basis for combining the references in the manner recited in claim 1.

With regard to the first point of error and in contrast to the recited subject matter, the Moinpour reference is directed to a system for cleaning the edges of semiconductor wafers. As explicitly stated, the Moinpour reference is directed to cleaning the edges of a wafer “using an edge scrubbing mechanism that may be incorporated into a scrubbing tool.” Col. 2, lines 65-67. With regard to claim 1, the Examiner stated that the Moinpour reference discloses a holding structure (510) having members arranged to hold and rotate a substrate (502) about a first axis. Appellants respectfully traverse this assertion.

The Moinpour reference discloses edge rollers (510) provided to rotate wafer (502) in a counter-clockwise direction. Col. 4, lines 30-32. The Examiner relies on Figure 5B of the reference as disclosing certain elements of the present invention. Contrary to the Examiner’s assertion, the edge rollers (510) cannot be fairly characterized as “a holding structure having members arranged to *hold* and rotate” a wafer as recited in claim 1. Emphasis added. Indeed, the edge rollers (510) do not *hold* a wafer at all. The edge rollers (510) are simply implemented to rotate the wafer (502) in a counter-clockwise direction under the control of motors (512) so that an edge cleaning apparatus (600) can scrub the entire circumference of the wafer. As clearly illustrated in Figs. 5A and 5B as well as the corresponding description, the edge rollers (510) *do not* hold the wafer and thus, cannot be fairly characterized as a holding structure having members arranged to hold and rotate a wafer as recited in claim 1.

In the Final Office Action, dated November 28, 2003, the Examiner found Appellants' prior remarks unpersuasive and stated:

The applicant argues that the edge rollers (510) of the '857 patent does not hold the wafer at all, the examiner is disagree. The edge rollers play an important roll of supporting and rotating wafer counter clock wise during the process of cleaning, if there are no edge rollers, then the wafer does not has any support at all to hold it off.

To the contrary, as previously discussed, there is no support in the cited reference for the Examiner's assertion that the "edge rollers play an important role of supporting [the] wafer." If the edge rollers 510 played such an important role in supporting or holding the wafer, as the Examiner argues, then it would seem that the reference would at least indicate such. Instead, there is nothing to indicate that the edge rollers (510) are configured to *hold* the wafer. Indeed, the edge rollers (510) are only mentioned in two sentences (three lines) of the entire reference, entirely reproduced here: "[e]dge rollers 510 are provided to *rotate* wafer 502 in a counter-clockwise direction as indicated. Motors 512 are coupled to edge rollers 510 *to provide rotational movement to the wafer.*" Col. 4, lines 30-32 (emphasis added). Appellants would like to point out that the reference is completely silent with regard to the structure configured to hold the wafer. Accordingly, it is clear that the Examiner's assertion is wholly unsupported by the reference.

Still further, the Examiner misinterprets Fig. 5B of the reference in stating that "if there are no edge rollers, then the wafer does not [have] any support at all." It is clear that both the text and *figures* of the Moinpour reference never describe how the wafer is held or supported.

For example, in Figs. 2A, 2B, 3A, 3B, 4A, and 4B, the wafer is illustrated as floating in mid-air

as if not requiring any support. Clearly, the Moinpour system is not illustrated in its entirety, to avoid obscuring the Moinpour invention. *See* column 2, lines 58-60 (noting that “components, structures and techniques have not been shown in detail in order to avoid obscuring the present invention [of cleaning wafer edges]”). Likewise, Figs. 5A and 6, and Fig. 5B relied on by the Examiner, illustrate only elements that play a direct role in cleaning the wafer and do not illustrate elements that prevent the wafer from falling or sliding from the assembly. The Examiner’s suggestion that unless the edge rollers (510) support the wafer, the wafer has no support at all, completely ignores Moinpour’s explicit statements regarding the limited structures illustrated and described throughout the reference.

If the Examiner ultimately chooses to maintain this rejection, Appellants respectfully remind the Examiner of his duties and obligations under 37 C.F.R. § 1.104 and MPEP § 707.07 and request that the Examiner clarify his rejection and specifically cite the relevant passage(s) in the Moinpour reference disclosing that the edge rollers (510) are configured to support the wafer in any way. Further, if the Examiner asserts that the edge rollers (510) of the Moinpour reference inherently hold the wafer, Appellants respectfully assert that while Appellants are well aware that express, implicit, and inherent disclosures of a prior art reference may be relied upon in the rejection of claims under Section 103, Appellants are also well aware that the Examiner bears the initial burden of proving inherency and that this burden has not been met by the Examiner’s unsupported assertions. The fact that a certain result or characteristic *may* occur or be present in the prior art is not sufficient to establish the inherency of that result or characteristic. *In re Rijeckaert*, 28 U.S.P.Q.2d 1955, 1957 (Fed. Cir. 1993); MPEP § 2112. In relying upon the theory of inherency, the Examiner must provide a basis in fact and/or technical reasoning to

reasonably support the termination that the alleging inherent characteristic *necessarily* flows from the teachings of the applied prior art. *Ex parte Levy*, 17 U.S.P.Q.2d 1461, 1464 (Bd. Pat. App. & Inter. 1990); MPEP § 2112.

Further, while Appellants respectfully submit that the edge rollers (510) do not hold the substrate, even if it could, inherency cannot be established by probabilities or possibilities -- the mere fact that a certain thing may result from a given set of circumstances is not sufficient. *In re Olerich and Divigard*, 212 U.S.P.Q. 323, 326 (C.C.P.A. 1981). Because it is clear that the capability of the edge rollers (510) to hold a substrate does not *necessarily* flow from the teachings of the Moinpour reference, these elements cannot possibly be inherent.

With regard to the second point of error, the Matsukawa reference does not cure the deficiencies of the Moinpour reference and therefore, does not disclose all of the claimed elements. As admitted by the Examiner, the Moinpour reference does not disclose a “rotatable member configured to rotate the holding structure about a second axis different from the first axis,” as recited in claim 1. The Examiner cited the Matsukawa reference as providing a rotatable member configured to rotate the holding structure about a second axis different from the first axis. The Matsukawa reference discloses a cleaning system having a holding structure (111a, 111b) coupled to a rotating shaft (102). Matsukawa, column 6, lines 18-29. While the holding structure (111a, 111b) is coupled to a rotating shaft (102) that facilitates rotation of the wafer about the rotating shaft, the Matsukawa reference does not disclose any mechanism for rotating the wafer held in the holding structure (111a, 111b) about a second axis different from the first.

To accomplish rotation of the wafer about a second axis, such as one perpendicular to the wafer, the holding structure (111a, 111b) of the Matsukawa reference must first deposit the wafer onto the wafer support base 130 to allow the spin chuck 120 to rotate the wafer after the holding structure (111a, 111b) has released the wafer. Column 6, lines 35-50, column 7, lines 20-54. Thus, since the Matsukawa reference does not disclose a holding structure arranged to hold and rotate the wafer about a first axis, wherein the holding structure is coupled to a rotatable member configured to rotate the holding structure about a second axis, it is clear that the Matsukawa reference does not disclose all of the elements of the recited claims. Since the Matsukawa reference fails to cure the deficiencies of the Moinpour reference, it is clear that neither reference alone or in combination discloses each of the elements recited in claim 1, the cited combination cannot possibly render the recited subject matter obvious.

With regard to the third point of error, while it is clear that the cited combination fails to disclose all of the elements necessary to support a *prima facie* case of obviousness, there is also no suggestion to combine these references in the manner recited in the present claims. It is well settled that when prior art references require a selected combination to render obvious a subsequent invention, there must be some reason for the combination other than the hindsight gained from the invention itself, i.e., something in the prior art as a whole must suggest the desirability, and thus the obviousness, of making the combination. *Uniroyal Inc. v. Rudkin-Wiley Corp.*, 837 F.2d 1044, 5 U.S.P.Q.2d 1434 (Fed. Cir. 1988); *see also* M.P.E.P § 2143.01 (noting that the mere fact that references *can* be combined or modified does not render the

resultant combination obvious unless the prior art also suggests the desirability of the combination).

Specifically, Appellants would like to address the Examiner's assertions regarding the suggestion to modify the cleaning system disclosed in the Moinpour reference. The Examiner stated that the Moinpour reference could be modified by providing the flipping feature as taught by Matsukawa for "the purpose of providing the ability for testing system to test the wafer from different angle." However, as previously discussed, the Moinpour reference is directed to *cleaning* a wafer, not *testing* a wafer. Accordingly, the technique disclosed by the Moinpour reference provides an apparatus for cleaning the edges, top surface and bottom surface of a wafer. Because the Moinpour reference already teaches a technique for cleaning every surface of the substrate, including the edges of the substrate, there would be no motivation to further modify the technique with aspects of the Matsukawa reference. The Examiner's assertion that one skilled in the art would be motivated to modify the *cleaning* system of Moinpour to provide the ability to *test* a wafer from different angles is without merit.

Further, Appellants assert that incorporating the holding structure (111a, 111b) of Matsukawa into the cleaning apparatus of Moinpour would actually *hinder* cleaning of the wafer edges, as taught by the Moinpour reference. If a proposed modification renders the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. M.P.E.P § 2143.01 (citing *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984)). Here, for example, encasing the Moinpour wafer edges with the Matsukawa holding structure (111a, 111b) would impede access to the edge of the

Moinpour wafer by the water/chemical supply nozzle 535, the belt 606, and so forth. It would also interfere with the rotating brushes 504 and 506 that clean the wafer surface. In sum, incorporation of the Matsukawa holding structure (111a, 111b) would frustrate the cleaning purpose in Moinpour and thus is not desirable.

Appellants respectfully submit that the Examiner has provided no reason at all as to why one skilled in the art would have been motivated to modify the Moinpour system by providing the flipping feature as taught by Matsukawa for “the purpose of providing the ability for testing system to test the wafer from different angle.” Rather, the Examiner has simply drawn a conclusion with nothing further. Indeed, without impermissible hindsight and the benefit of Appellant’s specification, even if the cited combination does disclose each of the recited elements, there is absolutely no suggestion or motivation in the cited references to combine the elements in the manner recited in the present claims. Accordingly claim 1 is believed allowable over the cited combination for these reasons as well.

With further regard to this point of error, even if the Examiner’s assertion regarding the suggestion to combine were tenable and even if the proposed combination did not render the invention being modified unsatisfactory for its intended purpose, there is also no reasonable expectation of success in modifying the Moinpour cleaning apparatus by incorporating the Matsukawa wafer flip and holding structure (111a, 111b) to accomplish the capability of the present claims. See M.P.E.P § 2143.02 (noting that there must be a reasonable expectation of success to modify or combine the prior art to reject claims as *prima facie* obvious). First, the Examiner has not explained the feasibility of flipping (rotating 180 degrees) the configuration of

cleaning elements in the Moinpour reference. The cleaning elements, such as the rotating brushes 504 and 506, belts 606, chemical/water supply 535, extended motors 512, and so forth, are not secured for a 180 degree rotation. Second, it is not clear as to how the supply of utilities, such as chemicals, water, electricity, and the like, to these cleaning elements would be accommodated in the flipping of the cleaning configuration. Third, the cleaning elements in Moinpour would obstruct inspection of a wafer. In total, the Examiner has not described how the cited combination would successfully accomplish the capability of the present claims. Accordingly claim 1 is believed allowable over the cited combination for these reasons as well.

In view of the remarks set forth above, Appellants respectfully submit that the cited combination does not disclose all of the elements set forth in the rejected claims, much less provide any suggestion to combine these disparate teachings to render the claimed subject matter obvious. Thus, Appellants respectfully submit that the subject matter of independent claim 1 is not rendered obvious by the cited references, either alone or in combination. Appellants also note that claims 2-7 ultimately depend from independent claim 1, and thus these dependent claims are patentable for the reasons provided with respect to independent claim 1. Accordingly, Appellant submits that claims 1-7 are currently in condition for allowance.

While Appellants respectfully submit that dependent claims 2-7 are patentable based on their dependency on claim 1 for the reasons set forth above, Appellants further submit that dependent claims 2 and 6 are also patentable by virtue of the additional subject matter separately recited in the claims, as discussed further below.

In rejecting claim 2, the Examiner correlated the edge rollers (510) with the *members* of the holding structure as recited in claims 1 and 2. This is inconsistent with the Examiner's rejection of claim 1 in which the same edge rollers (510) were correlated with the *holding structure* itself. Claim 1 recites "a *holding structure* having *members* arranged to hold and rotate the substrate about a first axis." Emphasis added. Thus, the present claims recite two distinct elements: a "holding structure" and "members." To establish *prima facie* obviousness, all the claim limitations, including these two distinct elements must be taught or suggested by the cited art. See M.P.E.P § 2142 (noting that all words in a claim must be considered in judging the patentability of that claim against the cited art).

As previously discussed, Appellants note that the Moinpour reference does not even disclose a holding structure having members arranged to hold and rotate a substrate, much less a holding structure having members comprising a plurality of wedge assemblies, as further recited in claim 2. To be clear, because the Moinpour reference does not disclose "a *holding structure* having *members* arranged to hold and rotate the substrate about a first axis," the reference cannot possibly disclose holding structure *members* comprising "a plurality of wedge assemblies configured to rotate the substrate about the first axis," as recited in claim 2. Appellants note that the Examiner failed to address Appellants' repeated requests (initially requested in the Response filed on February 7, 2002 and requested in each response thereafter) for clarification on how the Examiner is correlating the edge rollers (510) with the recited wedge assemblies. While Appellants traverse any suggestion that the edge rollers (510) can be properly correlated with the presently recited holding structure or with the presently recited members, Appellants further assert that those skilled in the art would find nothing in the Moinpour reference that could be

fairly characterized as a “wedge assembly,” as further recited in claim 2. Accordingly, Appellants respectfully submit that claim 2 is also allowable for the subject matter separately recited therein.

The Examiner rejected claim 5 on the basis of the Matsukawa reference, stating that the reference discloses the U shaped structure configured to open and close about the perimeter of the substrate as recited in claim 5. However, even if this were true, the Examiner made no statement regarding the “tensioning springs” recited in claim 6, which is dependent on claim 5. Appellants note that the Examiner failed to address Appellants’ repeated requests (initially requested in the Response filed on February 7, 2002 and requested in each response thereafter) for the Examiner to direct Appellants to anything in the Matsukawa reference that could possibly be correlated with the tensioning springs recited in claim 6. Indeed, Appellants maintain the position that these features are not disclosed in the Matsukawa reference or any of the art of record. Accordingly, Appellants respectfully submit that the Matsukawa reference fails to disclose the “tensioning springs” recited in claim 6 and respectfully submit that claim 6 is allowable based on its dependency on claim 1 and is also allowable based on the subject matter separately recited therein.

In sum, because the cited references do not disclose all of the elements, much less provide any suggestion to combine or modify the references in the manner recited in claim 1, they do not support a *prima facie* case for obviousness. Claims 3-5 are believed to be allowable based on their dependency on claim 1. Furthermore, claims 2 and 6 are believed to be allowable for their subject matter separately recited, as well as for the reasons provided above with respect

to independent claim 1. Claim 7 is believed to be allowable based on its dependency on claim 2.

Therefore, Appellants respectfully submit that claims 1-7 are currently in condition for allowance.

9. **CONCLUSION**

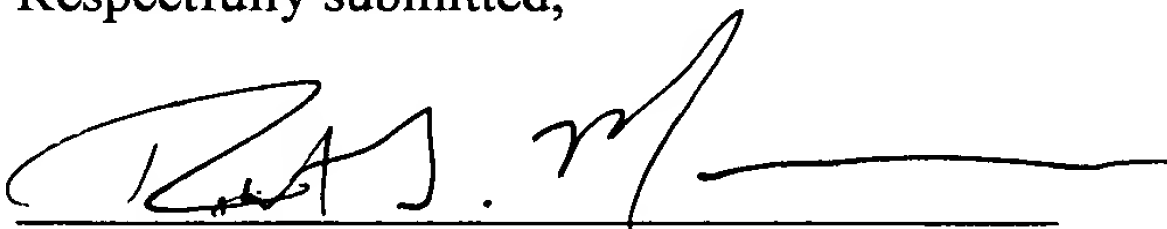
In view of the above remarks, Appellants respectfully submit that the Examiner has provided no supportable position or evidence that claims 1-7 are obvious under Section 103(a). Accordingly, Appellants respectfully request that the Board find claims 1-7 patentable over the prior art of record and reverse the Examiner's rejection of those claims.

In accordance with 37 C.F.R. § 1.136, Appellants request that this and any future reply requiring an extension of time be treated according to the General Authorization For Extensions Of Time previously submitted.

The Commissioner is authorized to charge the requisite fee of \$330.00, and any additional fees which may be required, to Deposit Account No. 13-3092; Order No. MICS:0053/FLE (99-0326).

Respectfully submitted,

Date: May 10, 2004


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10. **APPENDIX OF CLAIMS ON APPEAL**

1. (original) An apparatus for inspecting a disc-like substrate comprising a holding structure having members arranged to hold and rotate the substrate about a first axis, the holding structure being coupled to a rotatable member, the rotatable member configured to rotate the holding structure about a second axis different from the first axis.

2. (original) The apparatus, as set forth in claim 1, wherein the members comprise a plurality of wedge assemblies configured to rotate the substrate about the first axis.

3. (original) The apparatus, as set forth in claim 1, wherein the first axis is disposed generally perpendicular to a flat surface of the substrate and extends generally through an axial center of the substrate.

4. (original) The apparatus, as set forth in claim 1, wherein the holding structure comprises two L-shaped gripping arms arranged to form a single U-shaped structure and configured to hold the substrate substantially parallel to the gripping arms.

5. (original) The apparatus, as set forth in claim 4, wherein the U-shaped structure is configured to open and close about the perimeter of the substrate.

6. (original) The apparatus, as set forth in claim 5, further comprising tensioning springs configured to permit the U-shaped structure to open and close about the perimeter of the substrate.

7. (original) The apparatus, as set forth in claim 2, wherein the holding structure comprises three wedge assemblies, at least one wedge assembly coupled to a motor and configured to rotate the substrate about the first axis disposed generally perpendicular to a flat surface of the substrate and extending generally through an axial center of the substrate.